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A Scavenging Tendency of Modified Barks for Toxic Heavy Metal Ions with Reference to Wastes Obtained from Certain Plants

Dhananjay Dwivedi[1], Supriya Chouhan[2] and A.K. Gharia[3]

[1,3]Department of Chemistry,
P.M.B. Gujarati Science College, Indore, INDIA.
[2] Department of Chemistry,
S.B.N. Govt. P.G. College, Barwani, INDIA.

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ABSTRACT

A study has been made to know about binding possibilities of the toxic heavy metal ions with chemically treated wastes of plants material such as Techtona grandis (Teak), Pterocarpus marsupsium (Bijasal), and Accacia arbica (Babul). These plant materials are treated with formal dehyde in acid medium and it,s effectiveness in binding of toxic heavy metal ions such as Pb, Cd, & Cu by conducting equilibrium experiments are studied.

Keywords: Equilibrium, Scavenging, Inexpensive, Ion-exchange.

INTRODUCTION

Heavy metals are harmful and insidious pollutants because of their non biodegradable nature and their potential to cause adverse effects in humans beings beyond certain level of exposure and absorption. The toxic heavy metal ions which pose potential danger from the industrial waste water include Pb, Cd, & Cu. For the removal of these metal ions precipitation, ion-exchange, reverse osmosis, electrodialysis, adsorption by clays and activated carbon are some of the available techniques that plays their role in removal of heavy metal ions from industrial waste water[1].

Since most of the water bodies available are having open mixing and interactions with the effluents discharged continuously from battery and metal finishing units thus an interest has arisen recently in the investigations of some unconventional methods and material for scavenging heavy metal ions from industrial waste water[2].

This paper deals with the adsorbents prepared from some commonly available Indian tree barks such as Techtona grandis (Teak), Pterocarpus masrupsium (bijasal) and Accacia arbica (Babul) for the retrieval of toxic heavy metal ions from dilute aqueous waste solution[3,4]. Agricultural waste material such as waste wool[5,6,7] have been investigated.

MATERIAL AND METHODS

Equilibrium Experiments

1.5 gram of ground bark and 150ml of a test solutions containing heavy metal ions gently agitated at room temperature for half an hour. Further the obtained mixture was filtered and analysed for heavy metal ions absorbed on bark was calculated by difference between the initial and final concentration in solution phase.

Preparation of Bark Substrate

Sample of bark were dried at 50^0C for 24 hours and powdered in a grinder then passed through the sieve of 0.250mm. A mixture of one part of aqueous formaldehyde solution 39% and 20 parts by volume of 0.2 NH_2SO_4 was heated at 50^0C and 2 parts by weight of ground bark was added. The mixture was stirred for 1.5 hours at 50^0C and filtered through glass funnel. These samples were washed with cold water until the pH of the filtrate was 4 to 5. Thus obtained sample was then air dried for 24 hours at 50^0C.

RESULTS AND DISCUSSION

The bark samples selected for these investigations were Teak, Bijasal and Babul, available locally in plenty and are economic. Randall and coworkers have demonstrated that the binding of heavy metal ions on the western bark samples studied is pH dependent, it is because of presence of weak acid tannins in the bark helps ion exchange process between divalent metal ions bound to solid with two hydrogen ions[8].

Table I presents the pH levels of double distilled water solution after allowing contact with different barks (1.5 gram of bark per 150ml of water) for 24 hours. It is notable too that pH of the equilibrium solutions vary from 4.6 (babul bark) to 5.6 (In case of bijasal) after 24 hours.

Table-I Acidity of bark in contact with water

S. No	Substrate	pH after half an hour	pH after 24 hour
1	Water	6.9	-
2	Techtona grandis (Teak)	5.9	5.1
3	Accacia arbica (Babul)	4.6	4.6
4	Pterocarpus marsupsium (Bijasal)	6.0	5.6

- 1.5 part of substrate contacted with 100ml of water.

Table II shows the concentration of the heavy metal ions in solutions (ppm) after contacting with 150ml of the metal solutions at different pH.

Table-II Effect of pH on uptake of selected heavy metal ions during contact with acacia bark.

Metal ions	Pb^{2+}	Cd^{2+}	Cu^{2+}
Intial concentration (ppm)	108.0	78.0	39.0
pH 2.0	46.5	55.9	25.9
pH 3.0	11.9	36.0	14.6
pH 4.0	9.9	28.0	9.4
pH 5.0	6.5	14.0	4.9
pH 6.0	4.0	14.0	3.1
pH 7.0	3.99	10.9	10.1
pH 8.0	4.0	8.9	4.9
pH 9.0	4.0	7.9	2.4
pH 10.0	4.0	42.0	1.8
pH 11.0	4.9	31.5	1.3

- 1.5 part of substrate contacted with 150 parts of solutions for 30 minutes (Conce. of remaining ions are given as above).

It is obvious from the table that maximum uptake of metal ions occurs at pH-7 in case of lead, pH-8to9 in case of cadmium, pH-10to11 in case of copper. In all cases, it is found that with the increase of pH, uptake of the metal ions initially increases till maximum value with the pH is increased and then it fluctuates.

Table-III Removal of Pb^{2+}, Cd^{2+}, Cu^{2+} from solution of their different salts by contact with bark.

	$Cucl_2$			$CuSO_4$			$Pb(OAC)_2$			$Pb(NO_3)_2$			$Cd(OAC)_2$			$Cd(NO_3)_2$		
Substrate	T	B	A	T	B	A	T	B	A	T	B	A	T	B	A	T	B	A
Initial Conc .(ppm)	35.0	35.0	35.0	45	45	50.0	115	115	115	117	117	117	105	105	105	105	105	105
Final Conc. (ppm)	15.9	12.8	13.4	8.1	11.2	15.4	5.6	7.6	11.0	25.0	16.7	14.5	27.0	37.0	35.0	53	61.5	66
Initial pH	5.8	5.8	5.8	4.8	5.8	5.8	4.5	4.5	4.5	4.5	4.5	4.5	6.6	6.6	6.6	6.6	6.6	6.6
Final pH	3.5	3.4	3.3	4.0	4.2	3.3	4.5	3.8	3.5	3.1	3.2	3.2	4.6	4.2	4.2	3.7	3.3	3.3
% Removed from solution	64	74	68	93	84	77	97	98	94	88	91	94	78	68	70	52	43	38

- 1.5 part of substrate contacted with 100 parts of solution for 30 minutes T:Teak, B:Bijasal, A:Accacia

Results on the removal of copper ions from chloride and sulphate solutions, Lead ions from it's acetate and nitrate solution and cadmium ions from it's solutions of cadmium acetate and chloride. The percentage of copper removed from sulphate solutions with Teak is 93% while that recovered from chloride solution from bijasal and acacia are 74&77% respectively. As given in the table III that the metal removals from the sulphate solution with the various barks studied is in the range of

77to93% while that in the case of chloride solution it is 64 to 74%. It can be seen that all the barks tested bound the lead ion quite well the percentage of lead ion absorbed varying from 88to93% in case of nitrate solution while it is 94to98% in case of acetate solution. Best results are obtained using accacia and bijasal from nitrate of lead and acetate solution with various barks, it is estimated that the overall range of uptake of cadmium ions from chloride solution is 64to78% whereas from acetate solution it is 70to90%.

CONCLUSIONS

All the barks taken as samples studied namely Teak, Bijasal and accacia are inexpensive. This study confirms all these barks have appreciable affinity for binding the heavy metal ions like Cu^{2+}, Pb^{2+}, Cd^{2+}.

REFERENCES

1. Dean, J.C., Bosqui, F.L. and LANOUELETE, K.H., *Environ. Sci. Tech*., 6, 518-22 (1972).
2. Larry, J. RICCI, *Chem. Engg*., 105, 29-31 (1975).
3. Wing, R.E., Swanson, C.L., Doane, W.M. and Russel, C.R.,J. Water poll. *Control. Fed*., 46, 8, 2043-47 (1974).
4. Wing, R.E., Doane, W.M. and Russel, C.R., *J. Appl. Polym. Sci*. 19, 847-54 (1975).
5. M. Friedman, C.S. Harrison, W.H. Ward and Lundren, H.P., J.Appl. Polym. Sci., 17, 377-90 (1973).
6. M. Friedman and Masri M.S., *J. Appl. Polym. Sci.,* 18, 23667-77 (1974).
7. Masri, M.S. and Friedman, M., *Environ. Sci. Tech*., 7, 951-53 (1984).
8. Randall, J.M., Berman, R.L., Garrat, V., and Waiss, A.C. Jr., *Forest Prod. J*., 24, 80-84 (2002).